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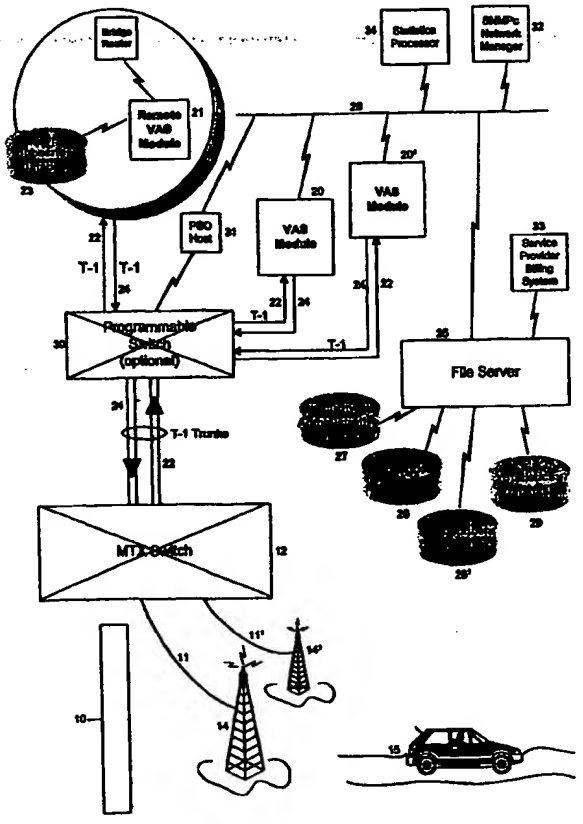
(54) Title: SIMPLIFIED TRAINING OF VOICE DIALING SYSTEMS

(57) Abstract

The present invention provides a method and system for storing a telephone number and additional access codes or menu selections as string data in association with a user–defined directory entry. The telephone number and access codes or menu selections are typically used to access an information service or network feature utilizing a voice activated dialing system. Once a user–defined entry and associated string data are stored, the user may speak the directory entry to cause the system to retrieve the corresponding string data so it may be used to access or control the information service. The system includes a call processor for identifying a user spoken command and a recognition subsystem for storing and retrieving a command string with a user–defined directory entry. The recognition subsystem captures a command string and stores it with a user–defined directory entry in response to the identified command being a training command. Commands identified as containing previously defined directory entries cause the recognition subsystem to retrieve the corresponding command string for manipulating an information system.



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SIMPLIFIED TRAINING OF VOICE DIALING SYSTEMS

Technical Field

This invention is related to telecommunications systems, and more particularly to an electronic digital signal processor-controlled telecommunications system allowing storage of user dialing entries not only for the directing of telephone calls based on spoken commands, but also including any other dialing information required to gain access to voice mail or other similar DTMF responsive systems.

Background Of The Invention

It is well-known that many of the safety hazards of cellular telephone use could be alleviated by utilizing automatic speech recognition. Even as voice controlled dialers are improving, cellular telephone users place even greater demands upon their communication systems. For instance, it is now common for a cellular telephone user to call voice mail or other information sources which are navigated by using DTMF (keypad tone) signals. This requires the cellular phone users to enter repetitive key pad strokes. It is therefore desirable to provide a voice activated system adaptable for this use. It is also desirable that the voice activated system store the repetitive key strokes and to be easily trainable in this respect.

There is therefore a need for an easily trainable user dialing entry system for use in the cellular network environment.

Brief Summary Of The Invention

It is therefore an object of the present invention to describe an implementation of an easily trainable user dialing entry system in a cellular or personal communications network environment.

It is the further object of the invention to describe a user dialing entry system for use at a mobile telephone exchange of a cellular or personal communications network. The placement of the system at the MTX significantly reduces cost and increases reliability by enabling the switch vendor to install and maintain the system in conjunction with the cellular switch.

These and other objects of the invention are provided in an advanced system for the recognizing of spoken commands over the cellular telephone or any personal communications (i.e., any non-wireline) network. In the cellular application, for example, the trainable user dialing entry system interconnects either internally with or as an external peripheral to a cellular telecommunications MTX switch. In the cellular environment, the trainable user dialing entry system will include an administrative subsystem, a call processing subsystem, a speaker-dependent recognition subsystem, a speaker-independent recognition subsystem, and a data storage subsystem. The administrative subsystem of the trainable system is used to keep statistical logs of pertinent call information. Pre-recorded instructional messages are stored in the memory of the call processing subsystem for instructing a user on his or her progress in using the system. The speaker-independent recognition subsystem allows the user to interact with the system employing non-user specific functions. User specific functions are controlled with the speaker-

dependent recognition subsystem. User specific attributes, including user dialing entries, collected by recognition subsystems are stored in the data storage subsystem.

The foregoing has outlined some of the more pertinent objects of the present invention. These objects should be construed to be merely illustrative of some of the more prominent features and applications of the invention. Many other beneficial results can be attained by applying the disclosed invention in a different manner or modifying the invention as will be described. Accordingly, other objects and a fuller understanding of the invention may be had by referring to the following detailed description of the preferred embodiment.

Brief Description Of The Drawings

For a more complete understanding of the present invention and the advantages thereof, reference should be made to the following Detailed Description taken in connection with the accompanying drawings in which:

Fig. 1 is a diagram of a representative cellular telephone network incorporating an external switch-based trainable user dialing entry system according to the present invention.

Fig. 2 is an upper level block representation of a trainable user dialing entry system at the switching office.

Fig. 3 is a high level flow chart showing the progress of a call utilizing a trainable user dialing system according to the present invention.

Detailed Description

Fig. 1 is a diagram of a cellular telephone network incorporating an external switch-based trainable user dialing entry system according to the present invention. Although the following description is specifically related to use of the trainable user dialing entry system at or in conjunction with an MTX of a cellular network, it should be appreciated that the system also interconnects either internally with or as an external peripheral to a personal communications network. Indeed, the principles of the invention are applicable to any cellular-like network application, i.e., where a nonwireline communications network is employed for mobile satellite, portable or personal communications. The trainable user dialing entry system can also be used as a shared resource through integration with a plurality of such nonwireline communications networks.

Referring now to Fig. 1, an exemplary telephone network is a cellular network 10 having a mobile telephone exchange (MTX) switch 12 connected to transceivers/antennas 14, 14'. Transceivers 14, 14' are located in each cell of the cellular network and communicate with the MTX to effect transmission and reception of signals to and from the mobile telephone located in vehicle 15. Each transceiver 14, 14' is typically connected to the MTX via a leased or dedicated network line 11, 11'. The MTX 12 is typically connected to the land-based destinations via telephone network.

A cellular mobile telecommunications system connects mobile telecommunications customers, each having a mobile unit to one another and to land-based customers served by a telephone network.

Incoming and outgoing calls are routed through an MTX Switch 12 connected to a group of cell sites that communicate with mobile units. The MTX Switch 12 routes the calls between the mobile units and the telephone network. In a typical mobile cellular communications system, there are usually many cells per MTX Switch 12 and several MTX switches per system. As used herein, "mobile telecommunications system" refers to both cellular, satellite and personal communications network environments.

Each cellular telephone is uniquely identified by two numbers: a serial number ("ESN") encoded in the phone by its manufacturer, and a mobile identification number ("MIN"), which is the cellular telephone number programmed in by the cellular service provider. The service provider operates the MTX Switch 12 and keeps a database of all MINs (and optionally their associated ESNs). Each time a call is placed by the cellular telephone, the service provider verifies whether the MIN is authorized. If the MIN of a cellular phone is not recognized, and the area code or provider designation of the MIN indicates that the phone number is outside of the provider's service area, the provider should prevent the caller from utilizing the voice dialing system. If the MIN indicates the caller is from within the provider's service area, but simply has not subscribed to voice dialing services, the caller may be offered the opportunity to subscribe to these services.

According to one embodiment of the invention as shown in Fig. 1, a trainable user dialing entry system 20 is connected as an external peripheral to the MTX through a set of preferably digital trunk lines 22, 24. The MTX may also be able to access remote trainable user dialing entry systems 21 for customers who have traveled to an MTX location beyond their home calling area. Trunk line set 22 is used for incoming signals and trunk line set 24 is used for outgoing signals. Other types of signaling, such as CEPT El or analog, may also be used besides T1. As shown in Fig. 1 the speech recognition and trainable system ("VAS") 20 is connected to a dedicated data storage subsystem 26 through a data network 28. The data storage subsystem is used to store recognition data and user dialing entries derived from the subscribers to the voice dialing service as will be described. The speech recognition system 20 may be integrated with one or more switches (whether or not cellular) for use as a shared resource via incoming and outgoing trunk sets connecting with local area network 28.

Network 28 will typically also be connected with additional resources which provide network management 32, customer billing functions 33, security and administrative management 27, and subscriber and statistical database management 29.

Fig. 2 is an upper level block diagram of the trainable user dialing entry system 20 of Fig. 1. The system generally consists of a central processing unit ("CPU") 35, a speech recognition board 36, such as the VPRO 88 sold by Voice Processing Corporation, video board 37, a disk drive controller with associated hard disk drive(s) 38, telephone interface boards 39, and local area network ("LAN") interface board(s) 40. A pulse code modulation ("PCM") bus 41 also connects the telephone interface boards 39 directly to the speech recognition board(s) 36. A single CPU 35 can typically manage eight speech recognition boards 36.

The CPU 35 and associated control programs function as the administrative and call processing subsystems, the speech recognition board 36 and associated programs carry out the speaker-dependent and speaker-independent recognition subsystem functions, while the hard disk controller and drives 38, comprise the data storage subsystem. User information may be transferred to network data storage such as mass storage 45 over a local area network and retrieved on an as needed basis.

Fig. 3 is a high level flow chart showing the progress of a call. The call is initiated by a cellular customer in step 50.

As illustrated in Fig. 1, when the mobile subscriber or caller initiates a call from a cellular handset, usually in an automobile 15, the call is received at cell site 14, and connected to MTX 12. In step 51, the MTX 12 routes the call to trunk group 22, 24 connected by programmable-switch 30 and the caller's MIN is outpulsed to programmable switch 30. In step 52, the programmable switch 30 reports the incoming call event to the host 31. In step 53, the host commands the programmable switch 30 to connect the call to the voice recognition system or VAS 20. In step 54, the VAS 20 determines whether the caller is utilizing an existing directory entry or programming a new entry. Step 55 shows the continued progress if the caller is utilizing an existing directory while the step 65 shows the progress if the caller instead intends to program a new entry.

Typically, if the caller is utilizing an existing directory entry, he will simply speak the keyword CALL and the user defined name for the desired directory entry. On the other hand, should the caller desire to record a new entry, he would state the keyword DIRECTORY which would provide access to the directory menu with the ADD, REVIEW, and DELETE menu options. If the caller selects the ADD keyword from the directory menu, he will proceed to step 65.

Presuming that the caller is utilizing an existing directory entry as shown in step 55, VAS determines the desired directory name and retrieves the corresponding number and issues a hookflash to the programmable switch 30 which is reported to the host 31 as an event.

In Step 56, the host 31 commands the programmable switch 30 to park the incoming call. Next, in step 57, the host commands the programmable switch to attach DTMF receiver towards VAS 20 and play dial tone. In step 58, the VAS outpulses the desired number and remains online. These digits are reported to the host. In step 59, the host commands the programmable switch 31 to reroute the call to MTX 12, outpulsing the MIN received on the incoming call and the dialed number. In step 60, the introductory call progress events are reported to the host and monitored by VAS 20. Because the directory entry has not only the phone number, but also additional programmed access codes or menu selections to navigate through an information service, VAS outpulses those additional signals (or instructs the switch to send DTMF signals) in step 61 in response to call progress events and time delays. Then in step 62, VAS goes on hook terminating its connection to the call. Concluding call progress events are reported to the host in step 63, and in step 64, the host commands the programmable switch 30 to disconnect or reroute the call as necessary.

In the event that the caller is programming a new directory entry, VAS will first train or capture the directory name selected by the caller and determine the corresponding phone number. VAS then has the caller confirm that he wishes to continue training navigation entries. In step 66, VAS issues a hookflash to the programmable switch 30 which is reported to the host 31 as an event. The host commands programmable switch 30 to park the incoming call in step 67. In step 68, the host 31 commands programmable switch 30 to attach DTMF receiver toward VAS 20 and play a dial tone. In step 69, VAS 20 outpulses the phone number and a signal advising the switch 30 to connect the call to the host 31. VAS 20 remains conferenced to the call and the DTMF digits are reported to the host 31. In step 70, the host 31 commands programmable switch 30 to reroute the call to the MTX 12, outpulsing the phone number. In step 71, introductory call progress events are reported to the host 31 and monitored by VAS 20 as the caller is connected to the dialed information service. In step 72, the caller enters additional DTMF signals typically representing access codes or menu selections in response to prompts from the information service. VAS monitors and records the timing and DTMF signals. In step 73, the caller's inactivity or a defined command signal causes VAS to time out or conclude training. In step 74, VAS 20 instructs host 31 to drop the call to the information service and concluding call progress events are reported to the host 31. In step 75, the new directory entry with navigation information is confirmed by the caller to VAS 20 which updates its stored directory table in the data subsystem. Finally, in step 76, the host commands the programmable switch 30 to disconnect or reroute the call as necessary.

To provide a more detailed example of the actual navigation portion of the invention, a representative illustration is provided. The cellular customer initiates a call.

The MTX 12 receives the call and routes it to a trunk line in communication with a security and administrative system. The MIN is logged by that system which recognizes the call requires speech recognition. The call is then routed to the speech recognition system ("VAS") 20.

When the call is received by the VAS with the MIN, the VAS first determines whether the caller is a subscriber to the service. If not, the caller is introduced to the service and offered the opportunity to subscribe. Subscription information is sent to the provider's computer for billing purposes. Once the caller is a qualified subscriber, the caller is prompted for a command. Typical commands would include: "DIAL" as an instruction to call the following number; "CALL" to call the following key-word directory entry; "DIRECTORY" to add or delete directory entries; "LIST" to cause VAS to recite a list of all current directory entries; "HELP," and "REDIAL." In the preferred embodiment of the present invention, the caller will state the command "PROGRAM." When VAS retrieves this command, it goes into PROGRAM mode.

In the PROGRAM mode, the caller is prompted to speak a NAME and NUMBER in the same fashion that a directory entry would be made. For instance, as described in copending application Serial No. 60/032,177, VAS acquires and confirms the NAME and NUMBER combination and then asks the caller if he wishes to continue with "navigation." If the answer is "yes," the VAS instructs the caller to

hold while the number is dialed. The caller is instructed that after a specified period of inactivity, usually about 5 or 10 seconds (or the entry of a predetermined command such as "#*"), recording of the user's key pad entries (DTMF signals) will cease. VAS then sends the number to be dialed to contact the information service. Upon positive answer detection, the call is connected and the caller utilizes the telephone key pad to key-in the required access or network feature digit strings in the usual manner. As the caller dials this information, the DTMF tones, the timing between tones, and call progress signals that are encountered are recorded using the tone detective function of a voice processing card, such as the VPRO-88. The resulting information is interpreted and stored in a directory file appended to the DIRECTORY NAME/NUMBER combination.

An example of a complete dialing sequence for access to an office voice mail system could be:

"MAIL, 555-1212, answer detect, 3 second pause, #, 2 second pause 606, 2, 326#, 1"

In this case, the string recorded is interpreted as follows:

MAIL	speaker dependent directory name
555-1212	telephone number
Answer Detect	positive answer detection feedback
3 second pause	timing for automated attendant greeting
#	access code for external voice mail user
2 second pause	timing for initial voice mail run
606	subscriber mailbox number
2	menu selection (play messages)
326#	subscriber security access code
1	menu selection: play new messages

The caller having completed the necessary entries waits the necessary five or ten seconds (or enters a command) for the programming function to time out. Once the session is established with the desired information service, and times out due to the caller's inactivity or terminated by command, the call to the

information service is terminated. The caller is then prompted to confirm a successful connection in response to a prompt.

If the caller confirms a successful connection, the entry is stored and he may be returned to the higher level DIRECTORY menu where the ADD, REVIEW, or DELETE directory entries or RETURN to main menu options are available. If the connection is not successful, the caller is prompted to try again or return to the DIRECTORY menu.

The caller may then obtain access to his voice mail messages in future calls by accessing the service, speaking the command CALL and then speaking the keyword entry of his choice, or from the above example "MAIL." This will cause the phone number and DTMF tones necessary to connect with the information service and play the caller's voice mail messages without any further action by the caller. It will be understood that dialing information for other information services besides voice mail may be programmed in a similar fashion so that DTMF menu selections and security codes are automatically provided at the appropriate time by the system.

While only two principal embodiments of the present invention have been disclosed, it is to be understood by those skilled in the art that other forms can be adopted, all coming within the spirit of the invention and scope of the appended claims.

What is claimed is:

CLAIMS

1. A voice dialing system comprising:

a call processing subsystem for monitoring a telephone call between a user and an information service; and

a call recognition subsystem for capturing dialing entries provided by a user during a telephone call monitored by the call processing subsystem.

2. The system of claim 1 further comprising a data storage subsystem for storing the captured dialing entries.

3. The system of claim 1 wherein the call recognition subsystem identifies a keyword and command data for a dialing entry.

4. A method for controlling an information service with voice commands comprising the steps of:

determining whether a voice command is for data capture of a dialing entry;

monitoring a telephone call in response to said voice command being for data capture;

capturing keyword and command data provided by a user during the monitored telephone call; and

storing the keyword and command data for later retrieval in response to a voice command not requiring data capture.

5. The method of claim 4 further comprising the step of:

retrieving a dialing entry in response to the voice command not being for data capture of a dialing entry.

6. The method of claim 4 further comprising the step of:

terminating the capturing step in response to an expiration of a predetermined time period.

7. The method of claim 4 further comprising the step of:

terminating the capturing step in response to receipt of a termination command.

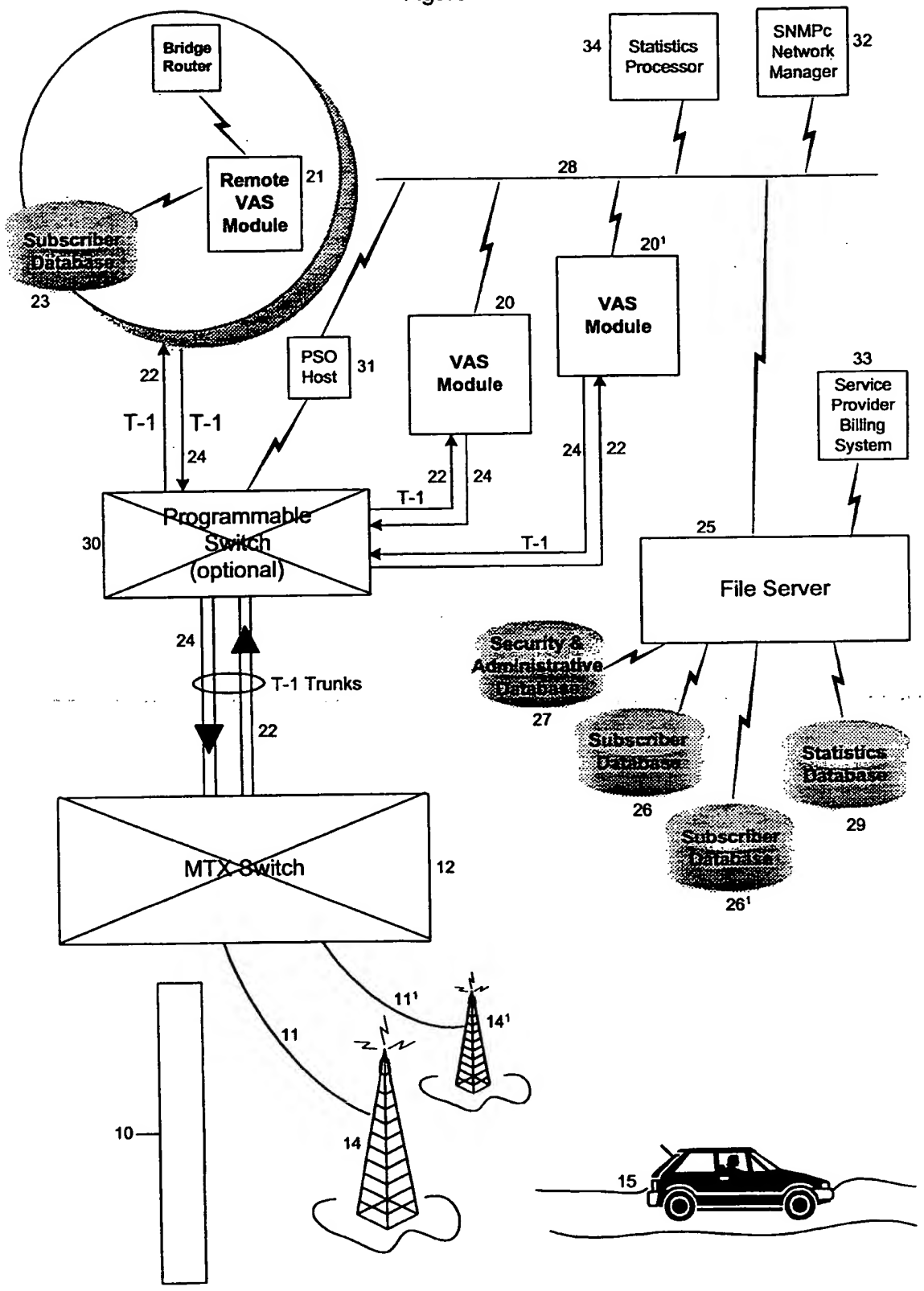
8. The method of claim 4 wherein the capturing step captures command data comprised of access codes and menu selection data for an information service.

9. The method of claim 4 further comprising the steps of:

transmitting the captured keyword and command data to the user for confirmation; and

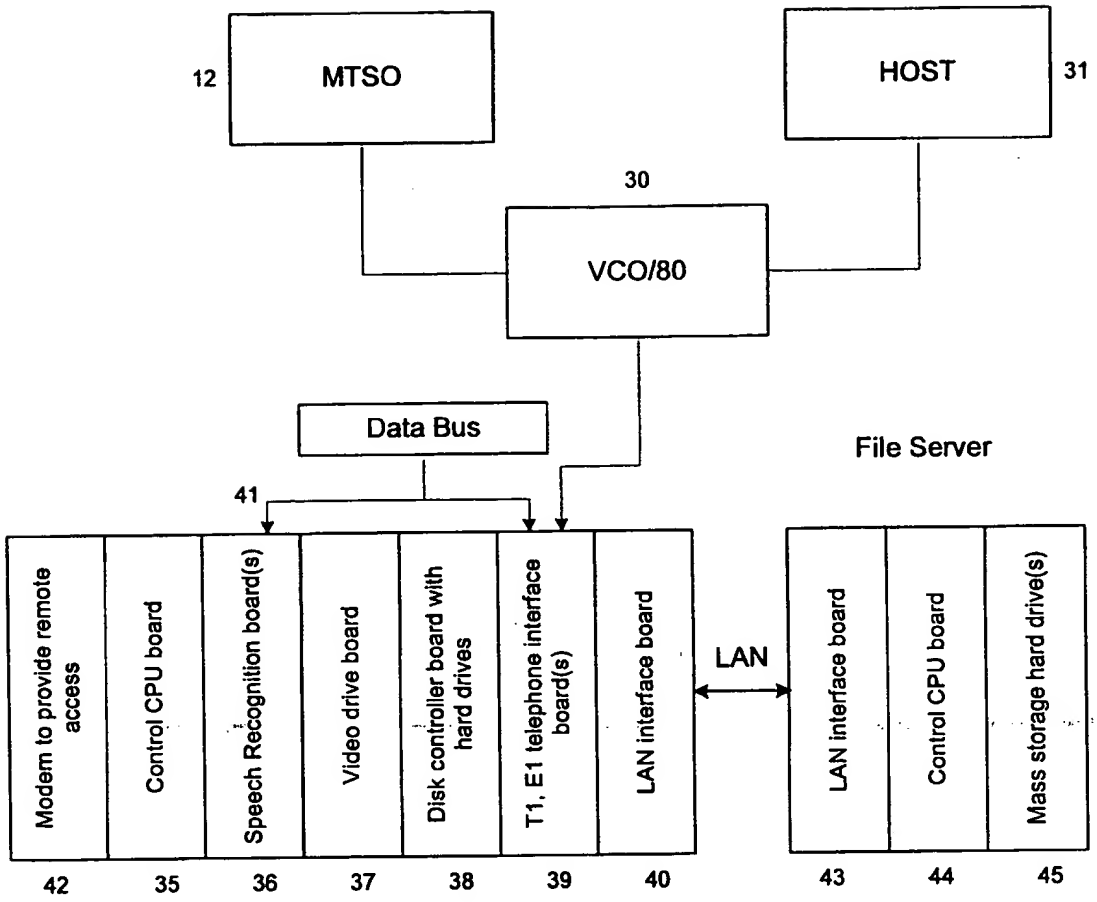
storing the captured keyword and command data in response to the user confirming the transmitted data.

Figure 1



SUBSTITUTE SHEET (rule 26)

Figure 2


12
MTSO
HOST
31
30
VCO/80
Data Bus
File Server
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Modem to provide remote access
Control CPU board
Speech Recognition board(s)
Video drive board
Disk controller board with hard drives
T1, E1 telephone interface board(s)
LAN interface board
LAN
LAN interface board
Control CPU board
Mass storage hard drive(s)
42
35
36
37
38
39
40
43
44
45

Figure 3A

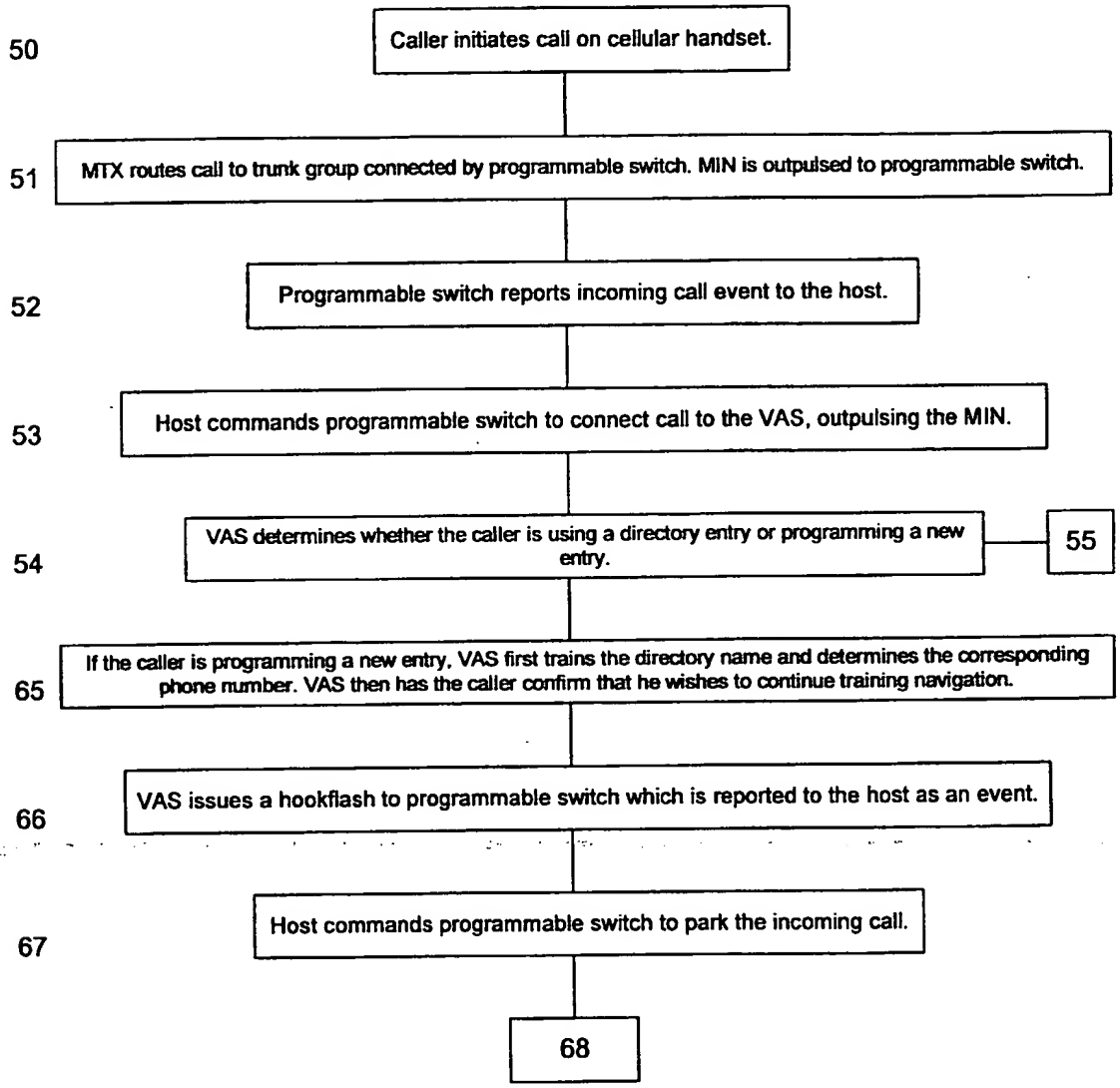

50
Caller initiates call on cellular handset.
51
MTX routes call to trunk group connected by programmable switch. MIN is outpulsed to programmable switch.
52
Programmable switch reports incoming call event to the host.
53
Host commands programmable switch to connect call to the VAS, outpulsing the MIN.
54
VAS determines whether the caller is using a directory entry or programming a new entry.
55
65
If the caller is programming a new entry, VAS first trains the directory name and determines the corresponding phone number. VAS then has the caller confirm that he wishes to continue training navigation.
66
VAS issues a hookflash to programmable switch which is reported to the host as an event.
67
Host commands programmable switch to park the incoming call.
68

Figure 3B

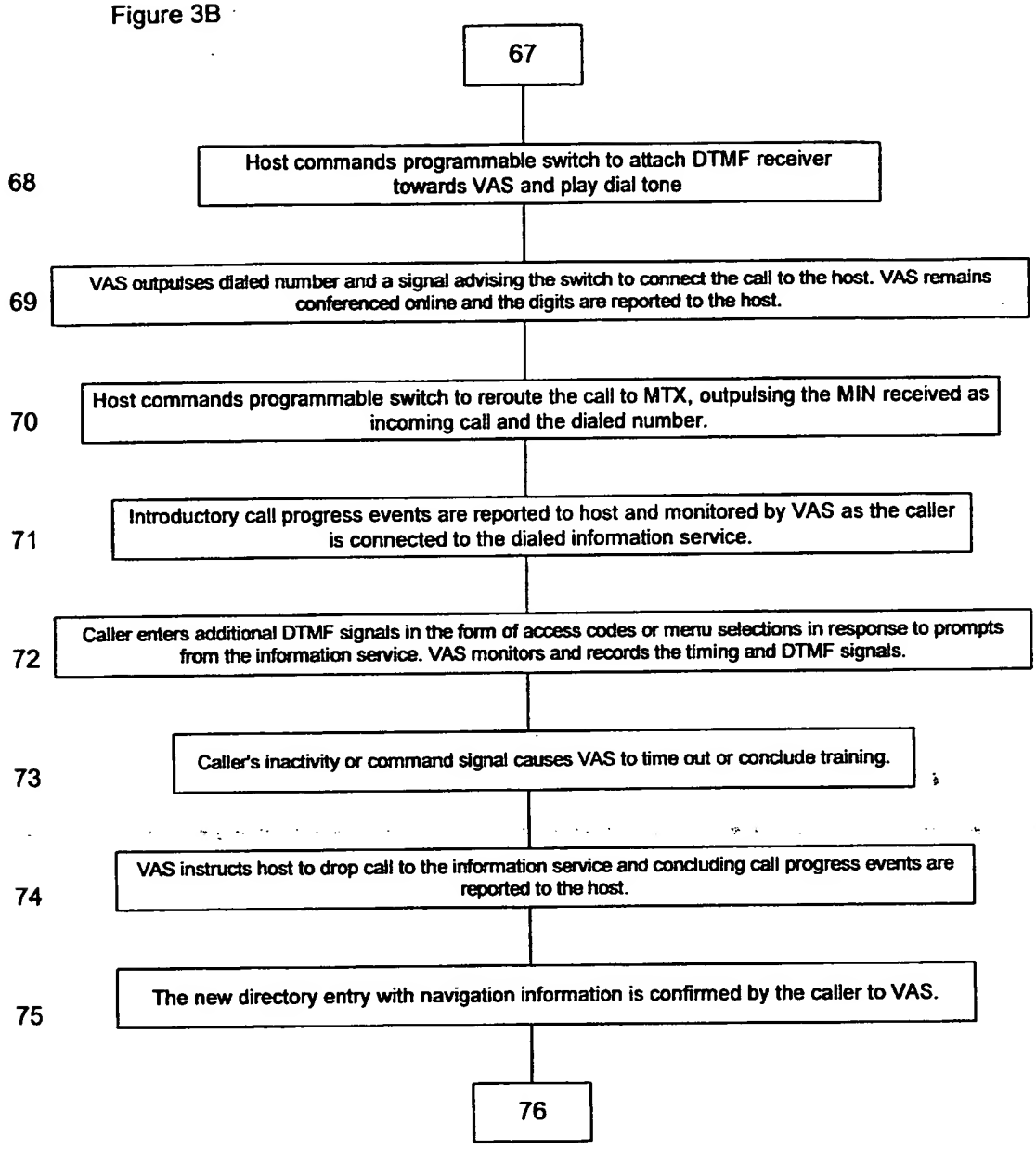
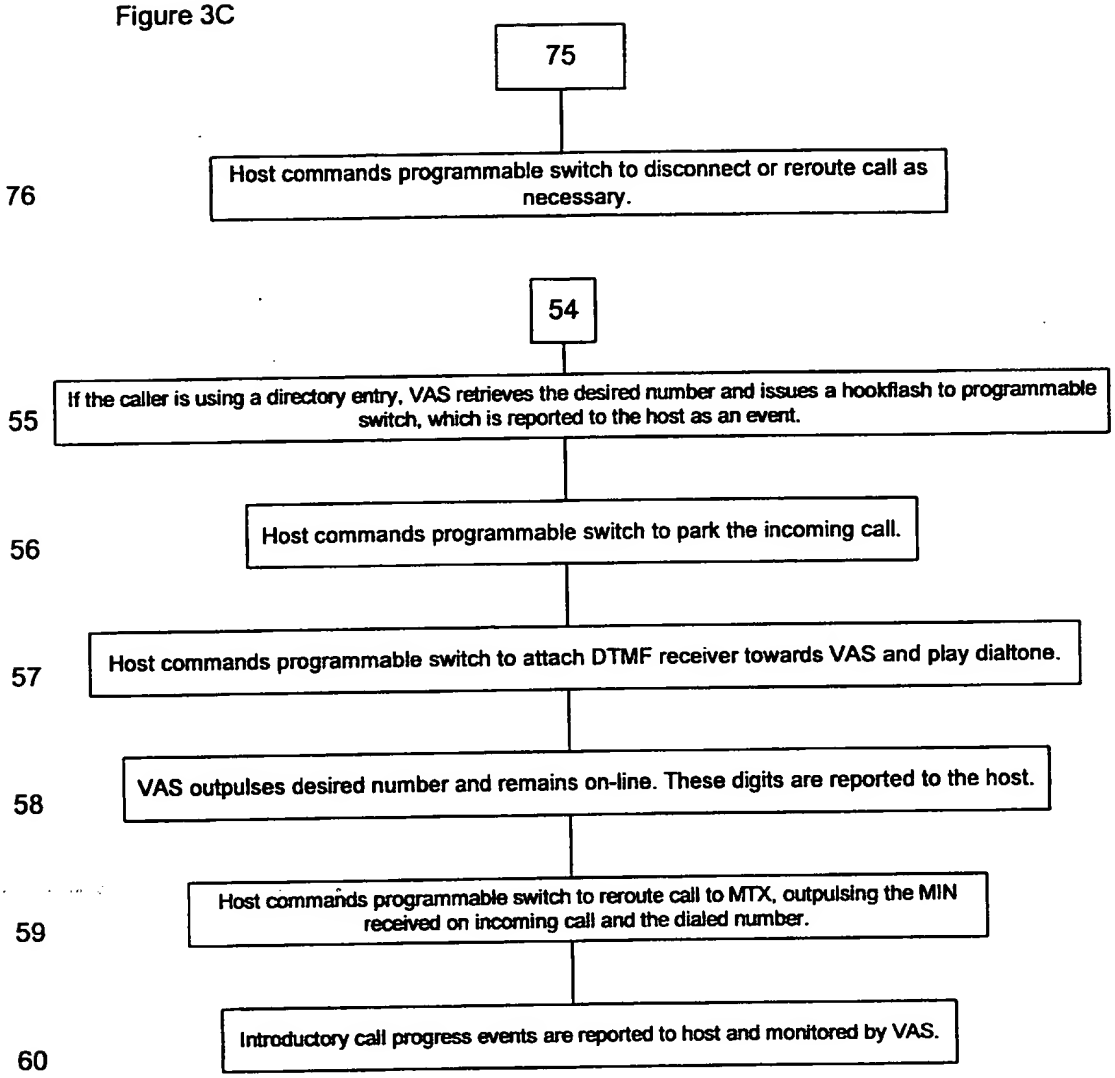

67
68
Host commands programmable switch to attach DTMF receiver towards VAS and play dial tone
69
VAS outpulses dialed number and a signal advising the switch to connect the call to the host. VAS remains conferenced online and the digits are reported to the host.
70
Host commands programmable switch to reroute the call to MTX, outpulsing the MIN received as incoming call and the dialed number.
71
Introductory call progress events are reported to host and monitored by VAS as the caller is connected to the dialed information service.
72
Caller enters additional DTMF signals in the form of access codes or menu selections in response to prompts from the information service. VAS monitors and records the timing and DTMF signals.
73
Caller's inactivity or command signal causes VAS to time out or conclude training.
74
VAS instructs host to drop call to the information service and concluding call progress events are reported to the host.
75
The new directory entry with navigation information is confirmed by the caller to VAS.
76

Figure 3C


75
Host commands programmable switch to disconnect or reroute call as necessary.
76
54
If the caller is using a directory entry, VAS retrieves the desired number and issues a hookflash to programmable switch, which is reported to the host as an event.
55
Host commands programmable switch to park the incoming call.
56
Host commands programmable switch to attach DTMF receiver towards VAS and play dialtone.
57
VAS outpulses desired number and remains on-line. These digits are reported to the host.
58
Host commands programmable switch to reroute call to MTX, outpulsing the MIN received on incoming call and the dialed number.
59
Introductory call progress events are reported to host and monitored by VAS.
60

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 98/19816

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04M3/50 H04Q3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04M H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 353 336 A (HOU MICHAEL M ET AL) 4 October 1994 see column 3, line 24 - line 42 see column 6, line 44 - column 7, line 27	1-5
A	see column 9, line 4 - column 12, line 19	6-9
X	US 5 661 784 A (ZINKE JOACHIM) 26 August 1997 see column 2, line 30 - column 3, line 15	1-5
A	EP 0 782 309 A (AT & T CORP) 2 July 1997 see the whole document	1-9
A	US 5 369 685 A (KERO TERRENCE E F) 29 November 1994 see the whole document	1-9

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 January 1999	08/02/1999

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International Application No
PCT/US 98/19816

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